

## WHAT IS CLAIMED IS:

1. An article protected by a protective coating, comprising:

a substrate having a substrate surface; and

a protective coating comprising an outer layer deposited upon the substrate surface and having a protective-coating outer surface, and a diffusion zone formed by interdiffusion of the outer layer and the substrate, wherein

*Sub A1*  
the outer layer comprises platinum, aluminum, no more than about 2 weight percent hafnium, substantially no added silicon, and elements diffused into the protective coating from the substrate, and wherein

the outer layer is substantially a single phase.

2. The article of claim 1, wherein the ~~substrate~~ is a nickel-base alloy.

3. The article of claim 1, wherein the article is a component of a gas turbine engine.

4. The article of claim 1, wherein the protective coating has an ~~average~~ hafnium composition profile comprising

*Sub A2*  
a relatively small first concentration of hafnium adjacent to the protective-coating outer surface,

a relatively large second concentration of hafnium, but not exceeding about 9 weight percent, at greater depths below the protective-coating outer surface, and

a relatively small third concentration of hafnium at yet greater depths below the protective-coating outer surface.

5. The article of claim 1, wherein the protective coating has an average hafnium composition profile comprising

*W2*  
from about 0.1 to about 0.5 weight percent hafnium averaged over locations from the protective-coating outer surface to a depth of about 5 micrometers below the protective-coating outer surface, and

from about 1 to about 9 weight percent hafnium averaged over locations from about 10 micrometers below the protective-coating outer surface to about 50 micrometers below the protective-coating outer surface.

6. The article of claim 1, wherein the protective coating has an average platinum composition comprising from about 20 to about 30 weight percent platinum averaged over locations from about 10 micrometers below the protective coating outer surface to about 20 micrometers below the protective coating outer surface.

7. The article of claim 1, wherein the protective coating has an average aluminum composition comprising from about 15 to about 25 weight percent aluminum averaged over locations from about 10 micrometers below the protective coating outer surface to about 20 micrometers below the protective coating outer surface.

8. The article of claim 1; further including

a ceramic thermal barrier coating overlying and contacting the protective-coating outer surface.

9. An article protected by a protective coating, comprising:

a substrate having a substrate surface; and

a protective coating comprising an outer layer deposited upon the substrate surface and having a protective-coating outer surface, and a diffusion zone formed by interdiffusion of the outer layer and the substrate, wherein

the outer layer comprises platinum, aluminum, hafnium, substantially no added silicon, and elements diffused into the protective coating from the substrate, and wherein the protective coating has an average hafnium composition profile comprising

from about 0.1 to about 0.5 weight percent hafnium averaged over locations from the protective-coating outer surface to a depth of about 5 micrometers below the protective-coating outer surface, and

from about 1 to about 9 weight percent hafnium averaged over

*Sub A5  
could*

locations from about 10 micrometers below the protective-coating outer surface to about 50 micrometers below the protective-coating outer surface, and wherein the outer layer is substantially a single phase.

10. The article of claim 9, wherein the substrate is a nickel-base alloy.
11. The article of claim 9, wherein the article is a component of a gas turbine engine.
12. The article of claim 9, wherein the protective coating has an average hafnium composition profile comprising

from about 0.1 to about 0.5 weight percent hafnium averaged over locations from the protective-coating outer surface to a depth of about 5 micrometers below the protective-coating outer surface, and

from about 1 to about 6 weight percent hafnium averaged over locations from about 10 micrometers below the protective-coating outer surface to about 50 micrometers below the protective-coating outer surface.
13. The article of claim 9, wherein the protective coating has an average platinum composition comprising from about 20 to about 30 weight percent platinum averaged over locations from about 10 micrometers below the protective coating outer surface to about 20 micrometers below the protective coating outer surface.
14. The article of claim 9, wherein the protective coating has an average aluminum composition comprising from about 15 to about 25 weight percent aluminum averaged over locations from about 10 micrometers below the protective outer coating outer surface to about 20 micrometers below the protective coating outer surface.
15. The article of claim 9, further including

a ceramic thermal barrier coating overlying and contacting the protective-coating outer surface.